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(54) Title: LUBRICANT COMPOSITIONS

(57) Abstract

A lubricant composition having biocidal properties comprises a cyclic imidazoline as the active lubricant in combination with sufficient acid to render the imidazoline soluble in water and optionally including amides and nonionic surfactants. The concentrate, when diluted for use, provides biocidal control action against yeasts and bacteria. The concentrate is preferably adjusted to a pH in the range of 3 to 8.

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LUBRICANT COMPOSITIONS

Field of the Invention

The present invention relates to lubricant compositions, and more specifically to lubricant compositions for use in lubricating the tracks which convey bottles, cans and similar containers and packages for beverages and other foodstuffs from one station to another in a packaging plant.

Background of the Invention

Beverages are sold in a variety of containers such as glass bottles, plastics bottles, plastic containers, cans, or waxed carton packs. These containers are conveyed through a number of stations in a plant where they are filled with the desired beverage; the containers are conveyed from one station to another by a track which is usually of stainless steel when the containers are glass bottles, or of a plastics material such as polypropylene or an acetal resin (sold under the name Delrin) when the containers are other than glass bottles. Such tracks will hereinafter be referred to as "conveyor track".

When the containers are being filled and transported, blockages occasionally occur preventing the free movement of the containers while the conveyor continues to move. In such instances it is important that the conveyor track is properly lubricated so that the track can continue to move even though the containers on the track are temporarily prevented from advancing.

In order to ensure smooth operation of the filling process, it is imperative to ensure that the conveyor track is properly lubricated and cleaned. If the conveyor track is not properly lubricated, the containers can easily fall over or fail to stop moving when they reach the appropriate station in the plant. This can cause serious disruption to the efficient operation of the filling process.

Lubricant compositions which are currently used for lubricating and cleaning conveyor track are generally of three main types:

(i) compositions based on fatty acids,

(ii) compositions based on fatty amines, and

(iii) compositions based on phosphate esters.

Aqueous solutions of fatty acids are not suitable for use in areas of hard water, unless they are stabilized by the incorporation of a complexing agent such as ethylenediamine tetra-acetic acid (EDTA).

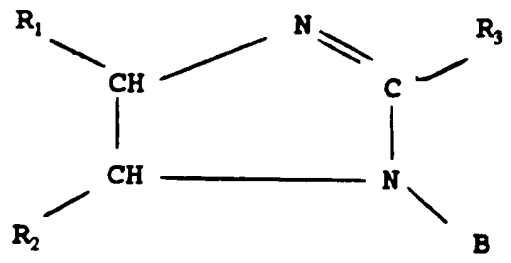
A problem encountered with the conveyor track is the need to keep the containers as free from microbial contamination as possible. This is especially important where soil spillage occurs, for example spillage of beer, orange juice, cola and other beverages.

We have now produced a new lubricating composition for use in lubricating conveyor track which has the advantage that it has biocidal properties as well as providing the necessary lubrication. Additionally, the biocidal properties do not appear to be detrimentally influenced by typical soil spillage.

Summary of Invention

According to one aspect of the present invention, there is provided a concentrate which, upon dilution with water, forms a lubricant composition for use as a lubricant for conveyor track. The concentrate comprises the following components:

(a) a cyclic imidazoline of the general formula (I)



(I)

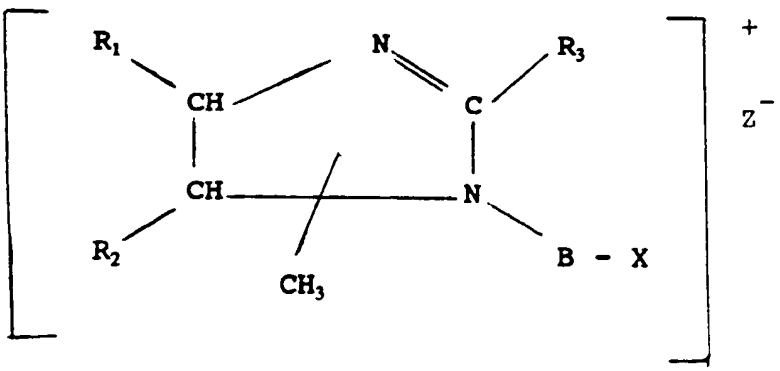
wherein R_1, R_2, and R_3 are the same or different and are each -H or -A -Y, in which A is a C_7 to C_{20} saturated or unsaturated, linear or branched chain alkylene group, B is a C_1 to C_{20} saturated or unsaturated, linear or branched chain alkylene group, Y is H, NH_2, OH, or $COOM_1$ in which M_1 is H or a Group 1 metal ion, and X is H, NH_2, OH, $COOM_2$ or $-NH-CO-R_4$, in which M_2 is the same or different from M_1 and is H or a Group 1 metal ion and R_4 is a C_1 to C_{20} saturated or unsaturated, linear or branched chain alkyl group; and

(b) an amount of acid sufficient to render the cyclic imidazoline soluble in water.

Generally, R_4 is a C_6 to C_{20} saturated or unsaturated linear or branched chain alkyl group and, preferably, at least one of R_1, R_2, R_3, B and R_4 includes a saturated or unsaturated linear alkylene group of at least 12 carbon atoms or a branched chain alkylene group also of at least 12 carbon atoms. This imparts useful lubricant properties to the concentrate. In a preferred embodiment, group A of the cyclic imidazoline has from 12 to 18 carbon atoms, most preferably 17 carbon atoms, so that the lubricity of the lubricant composition is optimized. Preferably, group B has from one to six carbon atoms, most preferably two carbon atoms, also to improve the lubricant properties of the composition. Preferably, X is NH_2. More preferably X is NH_2, R_1 and R_2 are H, R_3 is AY where A is C_{17} and Y is H.

In another embodiment, the concentrate comprises the following components:

(a) a cyclic imidazoline of the general formula (II):



(II)

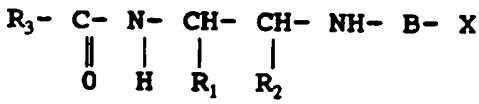
wherein the moieties R_1, R_2, R_3, B and X are each defined as for the cyclic imidazoline of general formula (I), the CH_3 ring substituent is present at position 1 or 3 of the ring, and Z^- is any suitable anion such as CH_3OSO_3; and

(b) an amount of acid sufficient to render the cyclic imidazoline soluble in water.

In a commercially available form of the cyclic imidazoline of general formula (II), group B has two carbon atoms and X is $-NH-CO-R_4$.

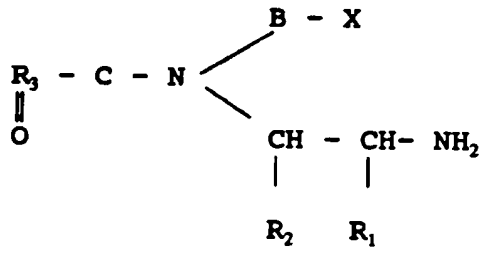
In a further embodiment, the concentrate comprises the following components:

(a) an amide of the general formula (III) or (IV):



(III)

or



(IV)

wherein the moieties R_1, R_2, R_3, B and X are each defined as for the cyclic imidazoline of general formula (I); and

(b) an amount of acid sufficient to render the amide soluble in water.

Detailed Description of the Preferred Embodimens

The compounds of general formula (III) or (IV) may be formed as by-products in the manufacture of the cyclic imidazoline (I) or may be formed during storage, dilution or acidification of the cyclic imidazoline (I), for example by hydrolysis. Direct synthesis of the compounds of general formula (III) or (IV) is also envisaged

without necessarily forming the compounds via a cyclic imidazoline intermediate.

Component (a) of the concentrate according to the present invention can therefore comprise mixtures of any two or more of the compounds (I), (II), (III) or (IV). A function of the acid in the concentrate is to neutralize and aid solution of component (a) in water. Whilst inorganic acids may be used, the imidazoline salts so formed would be less soluble than the corresponding organic salts. For this reason, organic acids are preferred. However, as the carbon chain length of the acid increases, sensitivity to hard water increases and so acids of chain length up to C_6 are preferred. As the carbon chain length increases beyond C_8, the acid and hence the formulation becomes unstable in hard water. The typical minimum amount of acid in the concentrate is that which is needed to neutralize component (a) although, in practice, it is preferable to add slightly more than equimolar quantities. Components (a) and (b) of the concentrate may be mixed together in solution or may be supplied together in the form of a salt of component (a) with the acid component (b) present as a suitable counterion, such as an acetate. Further acid or base may then be required to adjust the pH of the concentrate so as to optimize its lubricity in use. The preferred pH range for the concentrate is from 3 to 8, more preferably from 3 to 6.

Optionally, the concentrate further comprises one or more of the following components (c) (i), (ii) or (iii):

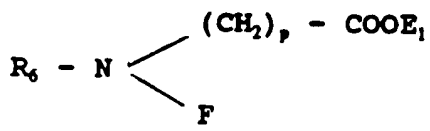
(c) (i) A non-ionic surfactant such as an alkoxylated phenol or alkoxylated alcohol in which the carbon chain of the alcohol is saturated or unsaturated, linear or branched.

(ii) An ether carboxylate of general formula (V):

$$R_5 - (OC_2H_4)_nOCH_2COOH \qquad (V)$$

in which R_5 is $CH_3-(CH_2)_m-$, where m is 0 or an integer from 1 to 20, preferably an integer from 2 and 17; or a C_2 to C_{20} unsaturated carbon chain; or a saturated or unsaturated branched chain; and n is an integer from 1 to 30, preferably from 2 to 9. Most preferably, R_5 is an oleyl group and n = 9: this material is available under the trade name Akypo RO 90 from Chemy.

(iii) an alkylamine carboxylate of general formula (VI):



(VI)

in which R_6 is a C_8 to C_{20} saturated or unsaturated, linear or branched chain alkyl group, E_1 is a hydrogen ion or a Group 1 metal ion and F is hydrogen or $-(CH_2)_q-COOE_2$ in which E_2 is a hydrogen ion or a Group 1 metal ion and is the same as or different from E_1; and p and q are the same or different and are integers from 1 to 12. Preferably R_6 is a Coco group (C_8 to C_{18} with a preponderance of C_{10}, C_{12} and C_{14} chains) and F is $-(CH_2)_q-COOE_2-$ in which p = q = 2, E_1 is a sodium ion and E_2 is a hydrogen ion. This material is available under the trade name Lakeland AMA from Lakeland Laboratories.

In a preferred embodiment, component (c) is the non-ionic surfactant Triton DF 16 available from Union Carbide which is defined by that company as a linear terminated ethoxylate.

The function of component (c) is primarily to reduce foam and to improve the soil handling properties of the final lubricant composition by emulsifying the soil components. If too much foam is produced in the lubricant composition, its ability to lubricate is greatly diminished. A further important function of the component (c) is to aid the solubilization or dissolution of component (a).

In addition to the above components a viscosity controlling agent may optionally be incorporated as a further component of the concentrate. Isopropyl alcohol is a typical viscosity controlling agent. However, glycol ethers, diols and glycols may also be used. The exact quantity would depend upon the desired viscosity of the final product.

Typically, the active amount of component (a) in the concentrate should be in the range 0.5 to 30 weight %, preferably in the range 2 to 20 weight %. On this basis, the active quantity of component (b) in the concentrate would fall within the range 0.05 to 10.5 weight %. if required, additional acid could be added to the concentrate to bring the pH into the required region. Concentrations of the remaining components are not critical.

According to a further aspect of the present invention there is provided a lubricant composition for use as a lubricant for conveyor track. The lubricant composition comprises a concentrate as defined above, diluted in water in the range 0.01 to 80%, preferably 0.05 to 5% (volume/volume). Water used for the dilution may be hard, soft or softened.

The exact dilution of the concentrate depends on factors such as the speed of the conveyor track, the type of package or container being carried by the track, the total loading on the conveyor track and the amount of soiling caused by spillage.

Dilution of the lubricant concentrate is normally performed at a central dispenser, and the diluted lubricant composition is then pumped to spray nozzles at the point of use. There are some areas of the conveyor track that require very little lubricant. Typically these are the zones before the filler and before the pasteurizer. In these regions secondary dilution is often employed. Lubricant is likely to be at its highest use concentration at and after the filler.

The lubricant solutions are typically sprayed onto the conveyor from fan jet nozzles placed at the start of each length of track. For particularly long runs, secondary spray jets may be positioned along the length of the track.

In areas of heavy soiling it may be necessary to spray lubricant onto the track continually. However, in most instances timers are employed to vary the dosing rate. Typically, on and off times will be between 10 and 90 seconds. Off times will not always equal on times. Also it is likely that throughout a plant timer settings will vary.

In some applications, a final water wash jet will be placed at the end of a bottle/can filling track. This will wash residues of lubricant from the package before crating and dispatching.

Excess lubricant will be allowed to fall from the track either to the floor or suitable drip trays. In either event it will eventually enter the drainage and water treatment systems.

The present invention is illustrated by the following Examples.

Example 1

A concentrate suitable for use upon dilution with water as a conveyor track lubricant was formulated in the following manner from the components set out in the Table below.

Table 1

Example Formulation

Raw Material	% wt/wt Bulk raw material	% wt/wt active raw material
Soft Water	77	77
Isopropyl Alcohol	3	3
Acetic Acid	5	5
1-amino ethyl 2 alkyl imidazoline	12	7.8
Alkoxylated nonionic surfactant	3	3

A typical manufacturing process for the formulation is as follows:

(1) Charge the vessel with soft water.

(2) Add isopropyl alcohol to the vessel and stir to disperse.

(3) Add acetic acid to the vessel and stir to disperse.

(4) Add the imidazoline and stir to dissolve.

(5) Add the nonionic surfactant and stir to dissolve.

Example 2

A concentrate suitable for use upon dilution with water as a conveyor track lubricant was formulated in the following manner from the components set out in the Table below.

Table 2

Example Formulation

Raw Material	% wt/wt Bulk raw material	% wt/wt active raw material
Soft Water	88.5	88.5
Acetic Acid	2.5	2.5
1-amino ethyl 2 alkyl imidazoline	4	2.6
Akypo R090	3	2.7
Lakeland AMA	2	0.6

A typical manufacturing process for the formulation is as follows:

(1) Charge a mixing vessel with the required water.

(2) Add the acid and stir to disperse.

(3) Add the imidazoline and stir to disperse.

(4) Add the Akypo RO90 and stir to disperse.

(5) Add the Lakeland AMA and stir to disperse.

Variation of the order of steps in the manufacturing process is possible. For example, where the water is added first of all, production of linear by-products of the imidazolines appears to be increased. Where water is added last, the formation of linear by-products appears to be minimized.

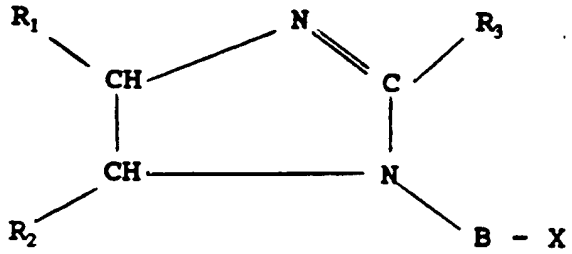
Some or all of the cyclic imidazoline of general formula I or II can be replaced by the linear amide of general formula III or IV.

Although preferred embodiments of the invention are described herein in detail, it will be understood by those skilled in the art that variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.

CLAIMS:

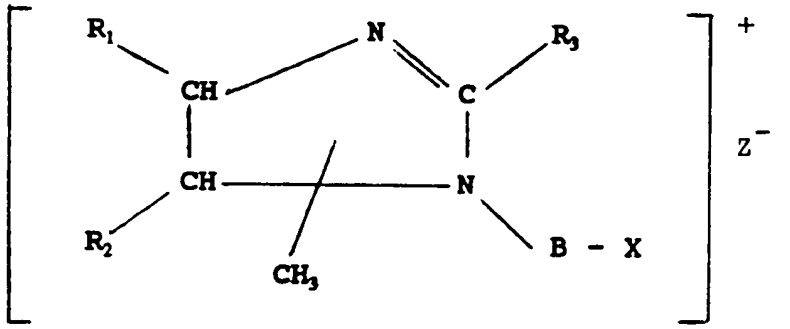
1. A concentrate which, upon dilution with water, forms a lubricant composition for use as a lubricant for conveyor track, which concentrate comprises the following components:

(a) (i) a cyclic imidazoline of the general formula (I):



(I)

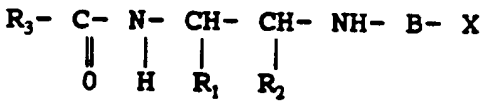
(a) (ii) a cyclic imidazoline of the general formula (II):



(II)

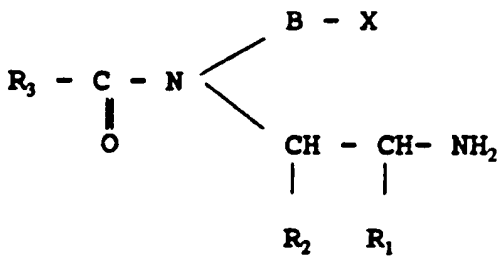
, and/or

(a) (iii) an amide of the general formula (III) or (IV):



(III)

or



(IV)

wherein R_1, R_2, and R_3 are the same or different and are each -H or -A -Y, in which A is a C_7 to C_{20} saturated or unsaturated, linear or branched chain alkylene group, B is a C_1 to C_{20} saturated or unsaturated, linear or branched chain alkylene group, Y is H, NH_2, OH, or $COOM_1$ in which M_1 is H or a Group 1 metal ion, and X is H, NH_2, OH, $COOM_2$ or $-NH-CO-R_4$, in which M_2 is the same or different from M_1 and is H or a Group 1 metal ion and R_4 is a C_1 to C_{20} saturated or unsaturated, linear or branched chain alkyl group and, in the cyclic imidazoline of general formula (II), the CH_3 ring substituent is present at position 1 or 3 of the ring, and Z^- is any suitable anion; and

(b) an amount of acid sufficient to render the cyclic imidazoline soluble in water.

2. A concentrate according to claim 1, wherein component (b) is provided with one or more of components (a) (i) (a)(ii), (a)(iii) or (a)(iv) in the form of a salt.

3. A concentrate according to claim 1 or claim 2, wherein at least one of R_1, R_2, R_3, B and R_4 includes a saturated or unsaturated linear alkylene group of at least 12 carbon atoms or a branched chain alkylene group of at least 20 carbon atoms.

4. A concentrate according to claim 3, wherein group A has from 12 to 18 carbon atoms.

5. A concentrate according to any one of the preceding claims, wherein group B has from one to six carbon atoms.

6. A concentrate according to any one of the preceding claims, wherein group X is NH_2.

7. A concentrate according to claim 6, wherein R_1 and R_2 are H, and R^3 is AY in which A has 17 carbon atoms and Y is H.

8. A concentrate according to any one of claims 1 to 4, which comprises the cyclic imidazoline of general formula (II) in which group B has 2 carbon atoms and group X is $-NH-CO-R_4$.

9. A concentrate according to any one of the preceding claims, wherein the acid comprises an organic acid of chain length up to C_6.

10. A concentrate according to claim 9, wherein the organic acid is acetic acid.

11. A concentrate according to any one of the preceding claims, which has a pH in the range 3 to 8.

12. A concentrate according to any one of the preceding claims, which further comprises one or more of the following components (c)(i), (ii) or (iii):

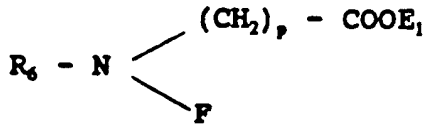
(c) (i) a non-ionic surfactant;

(ii) an ether carboxylate of general formula (V):

$$R_5 - (OC_2H_4)_nOCH_2COOH \qquad (V)$$

in which R_5 is $CH_3-(CH_2)_m-$, where m is 0 or an integer from 1 to 20, preferably an integer from 2 to 17; or a C_2 to C_{20} unsaturated carbon chain; or a saturated or unsaturated branched chain; and n is an integer from 1 to 30, preferably from 2 to 9.

(iii) an alkylamine carboxylate of general formula (VI):



(VI)

in which R_6 is a C_8 to C_{20} saturated or unsaturated, linear or branched chain alkyl group, E_1 is a hydrogen ion or a Group 1 metal ion and F is hydrogen or $-(CH_2)_q-COOE_2$ in which E_2 is a hydrogen ion or a Group 1 metal ion and is the same as or different from E_1; and p and q are the same or different and are integers from 1 to 12.

13. A concentrate according to claim 12, wherein the components (c)(i), (ii) and (iii) comprise:

(c) (i) a linear terminated ethoxylate;

(ii) the ether carboxylate of general formula (V),

in which R_5 is an oleyl group and n=9; and

(iii) the alkylamine carboxylate of general formula (VI), in which R_6 is a Coco group and F is $-(CH_2)_q-COOE_2$, in which p=q=2, E is a sodium ion and E_2 is a hydrogen ion.

14. A concentrate according to any one of the preceding claims, which further comprises a viscosity controlling agent.

15. A concentrate according to any one of the preceding claims, wherein the active amount of component in the concentrate is in the range 0.5 to 30 weight%.

16. A concentrate according to any one of the preceding claims, wherein the concentrate has a pH in the range of 3 to 6.

17. A lubricant composition comprising a concentrate according to any one of the preceding claims, diluted in water in the range 0.02 to 80% (volume/volume).

18. Use of a concentrate according to any one of claims to 16 in the lubrication of conveyor track.

19. Use of a concentrate according to any one of claims 1 to 16, at a dilution to provide biocidal control against yeasts or bacteria.

20. Use of a concentrate according to any one of claims 1 to 16, at a dilution to provide a lubricant solution compatible with plastics.

21. A process for producing a concentrate according to any one of claims 1 to 16, in which the following components are mixed together in any order:

(A) the cyclic imidazoline of general formula (I) or (II), or the amide of general formula (III) or (IV);

(B) acid;

(C) water; and optionally

(D) one or more of components (c)(i), (c)(ii), or (c)(iii).

22. A process according to claim 21, which process comprises the steps of:

(i) mixing the acid and water together to form diluted acid;

(ii) mixing the diluted acid with the cyclic imidazoline of general formula (I) or (II); and

(iii) optionally dispersing with the mixture formed in step (ii) one or more of components (c)(i), (c)(ii) or (c)(iii).

23. A process according to claim 21, which process comprises the steps of:

(i) mixing the acid with the cyclic imidazoline of general formula (I) or (II);

(ii) optionally dispersing with the mixture formed in step (i) one or more components (c)(i), (c)(ii) or (c)(iii); and

(iii) diluting the product thus obtained with water.

24. A process according to claim 21, which process comprises the steps of:

(i) mixing the acid and water together to form diluted acid;

(ii) mixing the diluted acid with the amide of general formula (III) or (IV); and

(iii) optionally dispersing with the mixture formed in step (ii) one or more of components (c)(i), (c)(ii) or (c)(iii).

25. A process according to claim 21, which process comprises the steps of:

(i) mixing the acid with the amide of general formula (III) or (IV);

(ii) optionally dispersing with the mixture formed in step (i) one or more components (c)(i), (c)(ii) or (c)(iii); and

(iii) diluting the product thus obtained with water.

INTERNATIONAL SEARCH REPORT

Inter ›nal Application No
PCT/CA 95/00024

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C10M173/02 //(C10M173/02,129:32,133:06,133:16,133:46,145:36), C10N30:16,C10N40:00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C10M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB,A,834 578 (STANDARD OIL COMPANY) 11 May 1960 see page 2, line 78 - line 97 see page 8, line 50 - line 75 see page 8, line 91 - page 9, line 5	1-7,15, 17,21
A	US,A,4 128 655 (J.H. HUNSUCKER) 5 December 1978 see column 1, line 62 - column 2, line 24 see column 2, line 43 - line 59	1,2,5, 12,15, 17,19
A	US,A,3 827 874 (P. ADAMS) 6 August 1974	1,2,5,6, 9,10,15, 17,19

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
25 April 1995	12.05.95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Hilgenga, K

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INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/CA 95/00024

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US,A,3 574 100 (C.A. WETMORE) 6 April 1971 see column 2, line 1 - line 30 see column 4, line 18 - line 24	1,12,13, 18
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A	WO,A,93 18121 (HENKEL KOMMANDITGESELLSCHAFT) 16 September 1993 see page 1, line 5 - line 12 see page 5, line 1 - page 6, line 4	1,3-5, 15,17, 18,20
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter nal Application No
PCT/CA 95/00024

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